

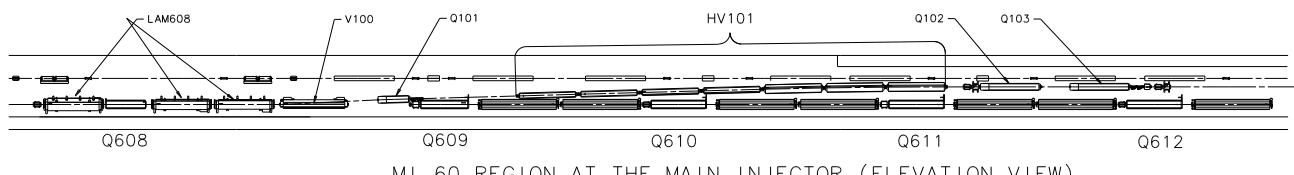
Optimization of NuMI Proton Beam Optics

Peter Lucas
Fermilab

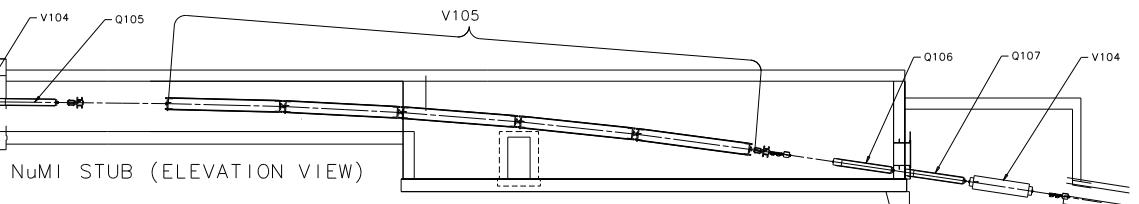
The MINOS Collaboration Meeting

at Caltech

January 3-6, 2002

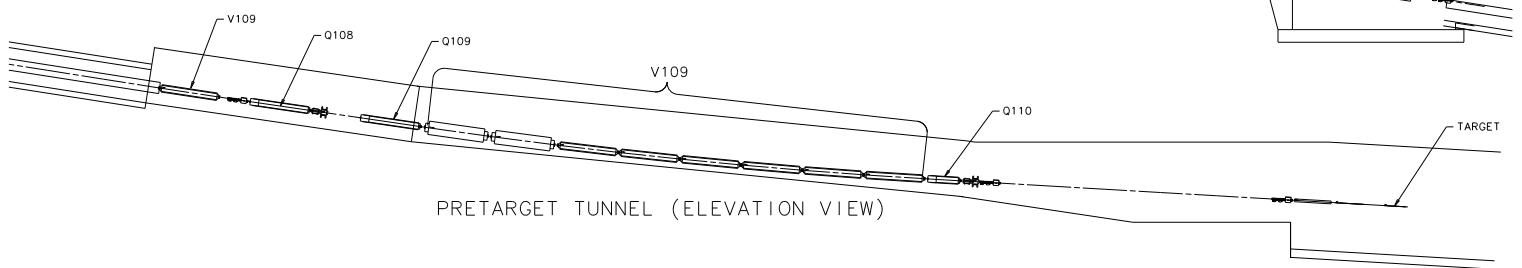


MI_60 REGION AT THE MAIN INJECTOR (ELEVATION VIEW)



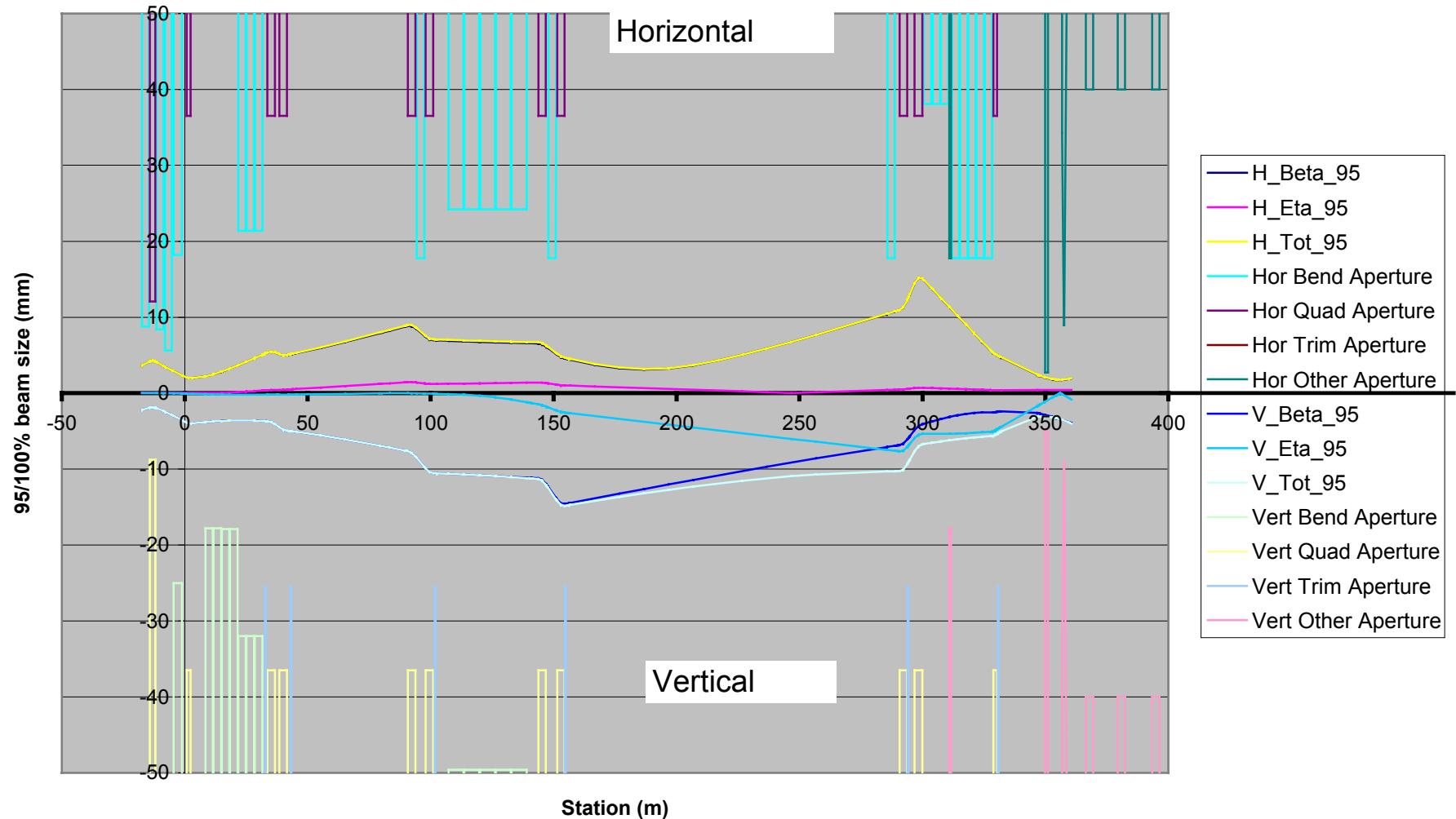
NuMI STUB (ELEVATION VIEW)

PRETARGET TUNNEL (ELEVATION VIEW)

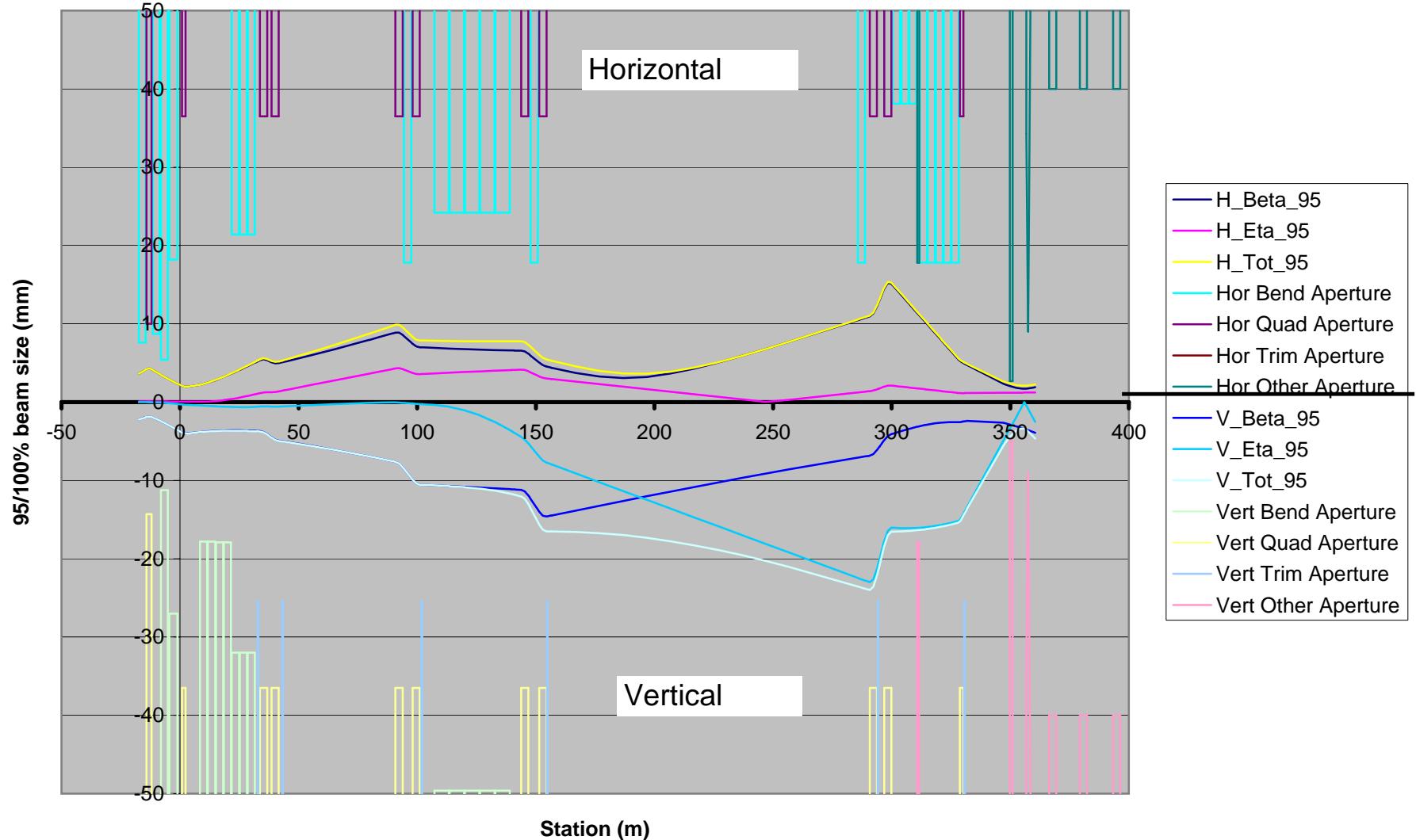


MD-363193
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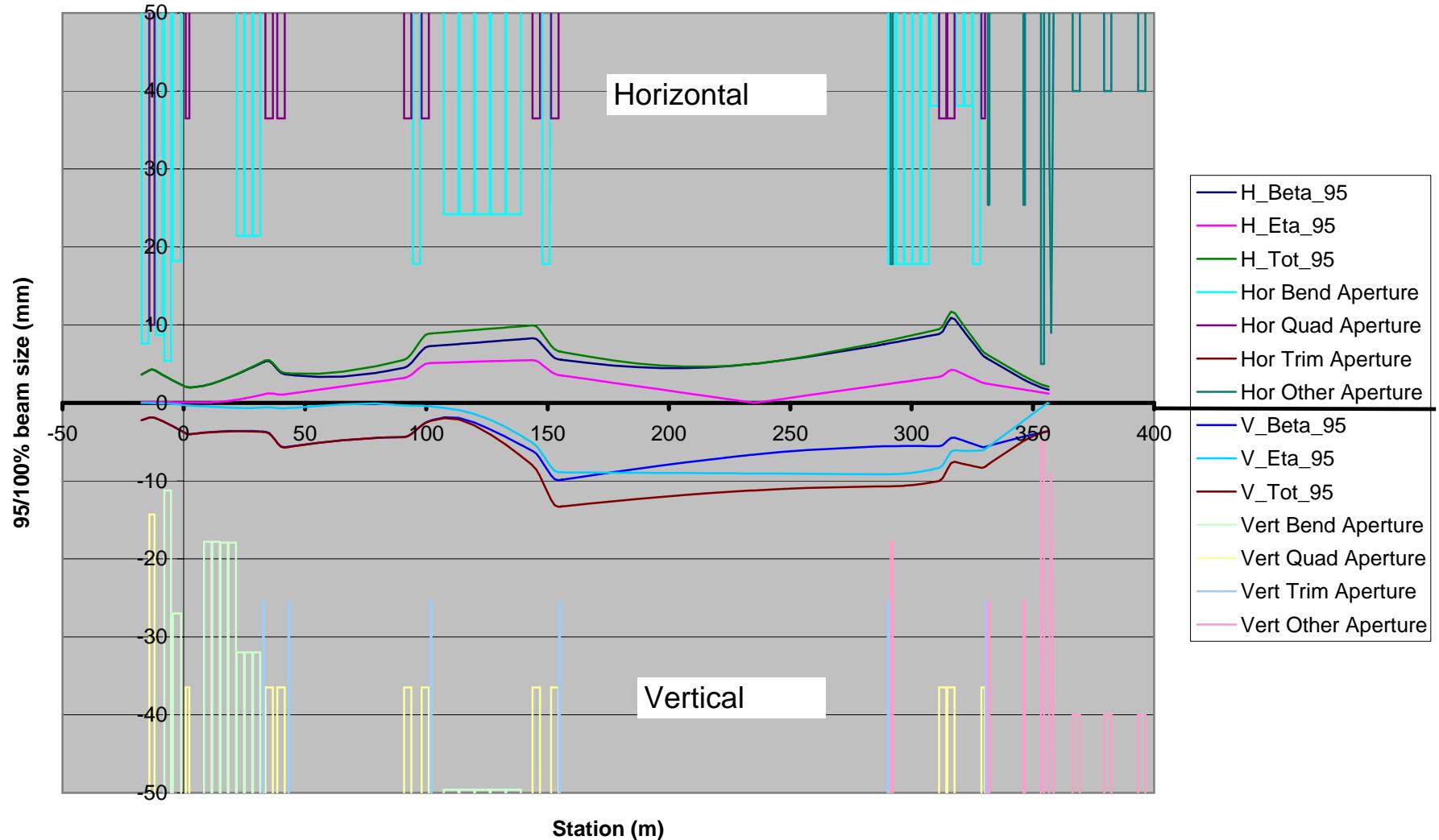
95/100% Beam Sizes and Apertures



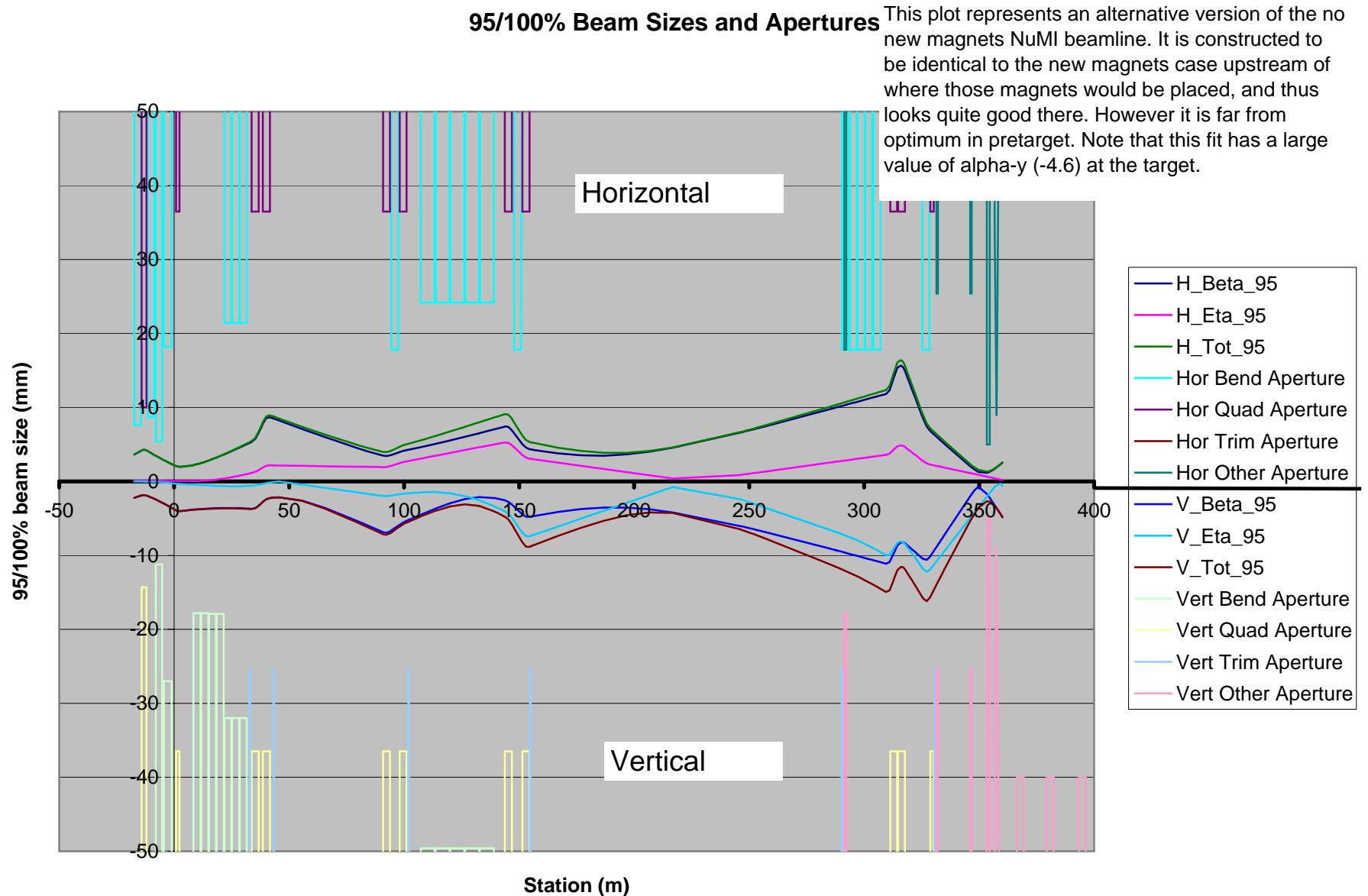
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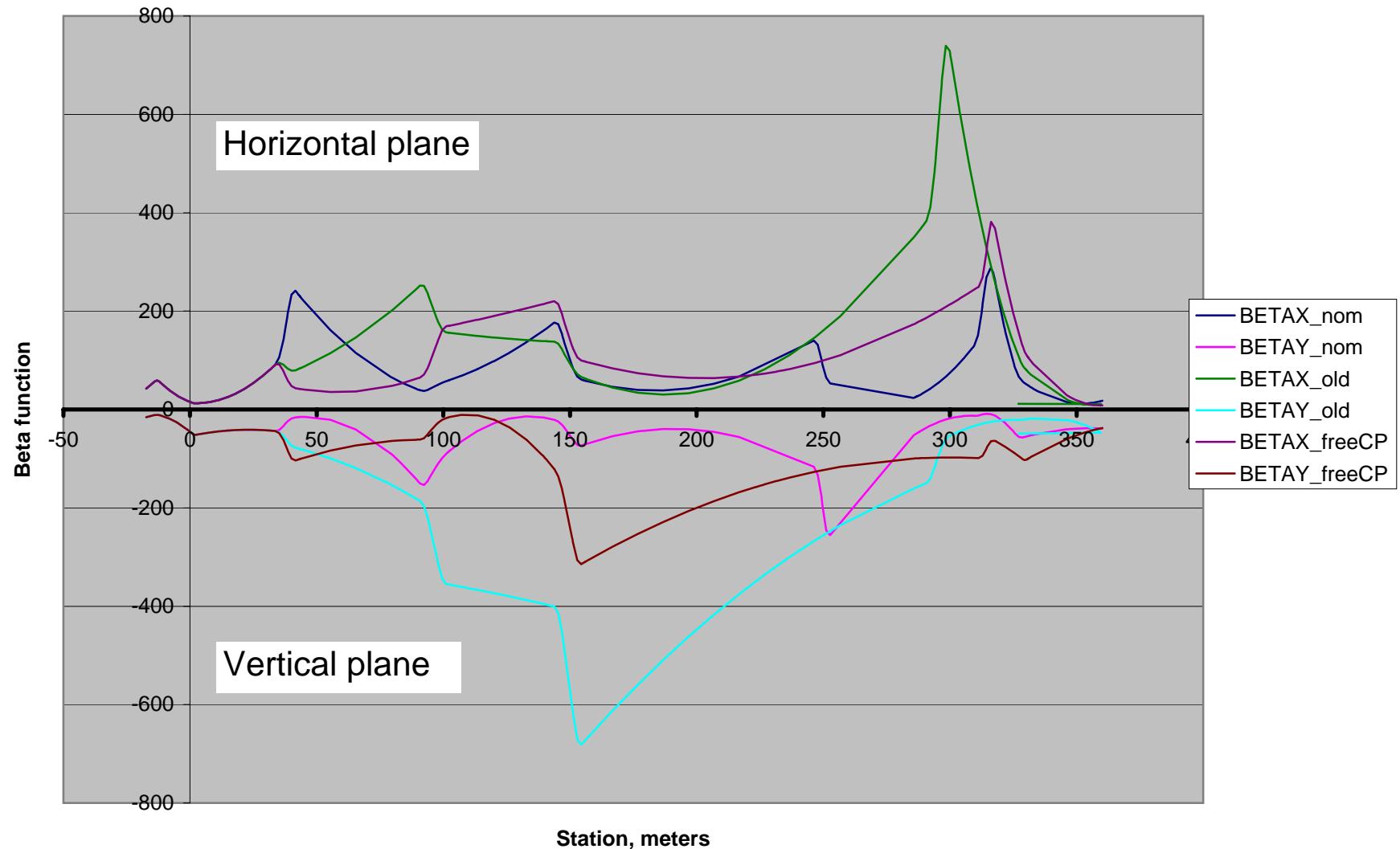
95/100% Beam Sizes and Apertures



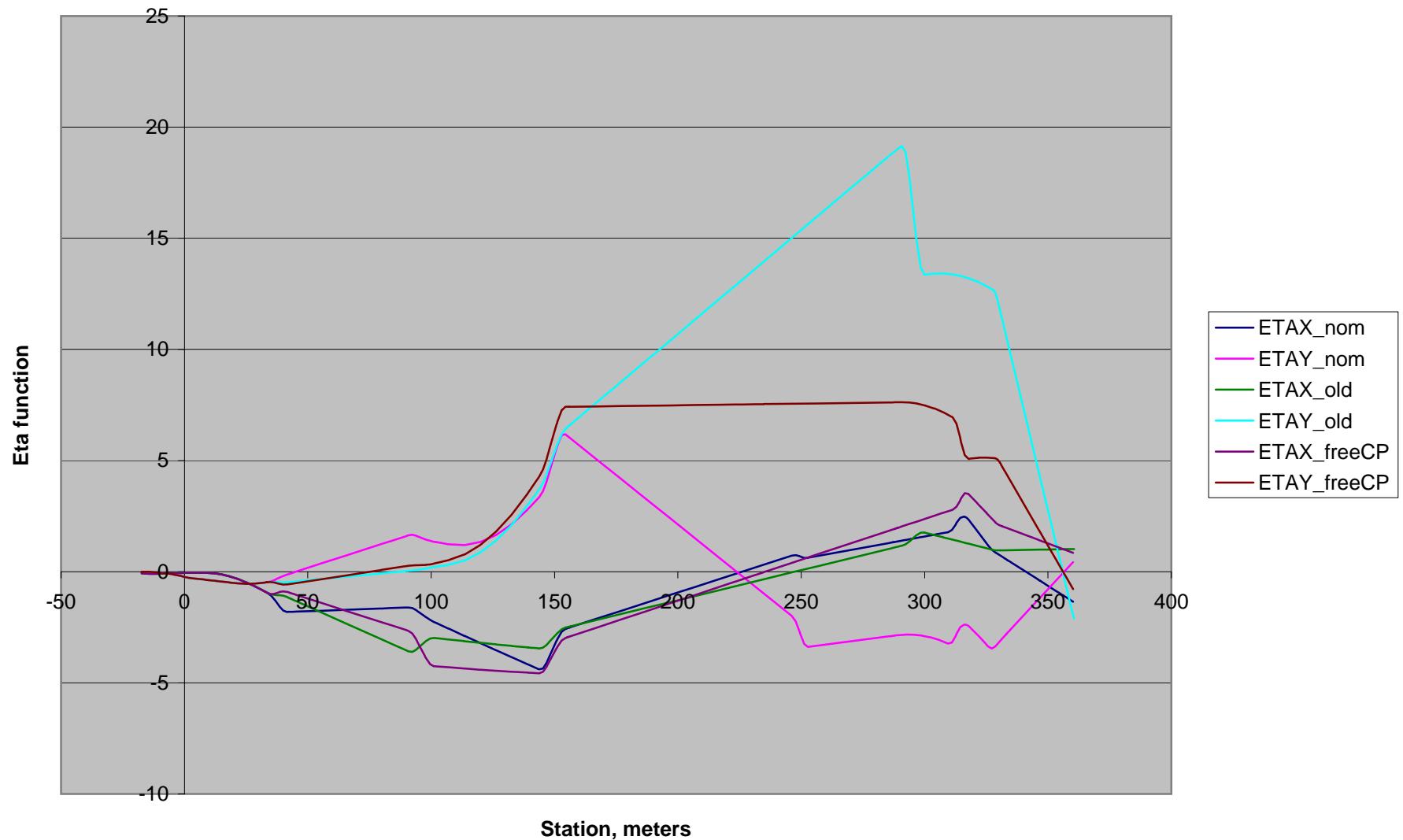
Changes in quad and dipole positions in pretarget hall change bend centers and resulting downstream trajectory

- In practice cannot change transverse position of target, buried in shielding
- Similarly cannot change targeting angle, which is set by location of far detector
- Turn two knobs - fields of EPB (V110) and 6-3-120 (V109) strings
 - (Note that these two strings have run at identical fields thus far)
 - Fit these two values to produce desired position and angle at target
 - Result is unfortunate - runs 6-3-120 string far into saturation
- Solution is a compromise:
 - Change the angle into pretarget by varying V105 string in stub, goes from -17.82 kgauss to -18.05 kgauss
 - This lowers elevation of beam by 2.3" at start of carrier tunnel and 11.2" at its end
 - Replace the ninth pretarget EPB dipole with a 6-3-120
 - V110 EPB string drops from 14.25 kgauss to 13.72 kgauss and V109 6-3-120 string goes to 15.50 kgauss, 1025 amps

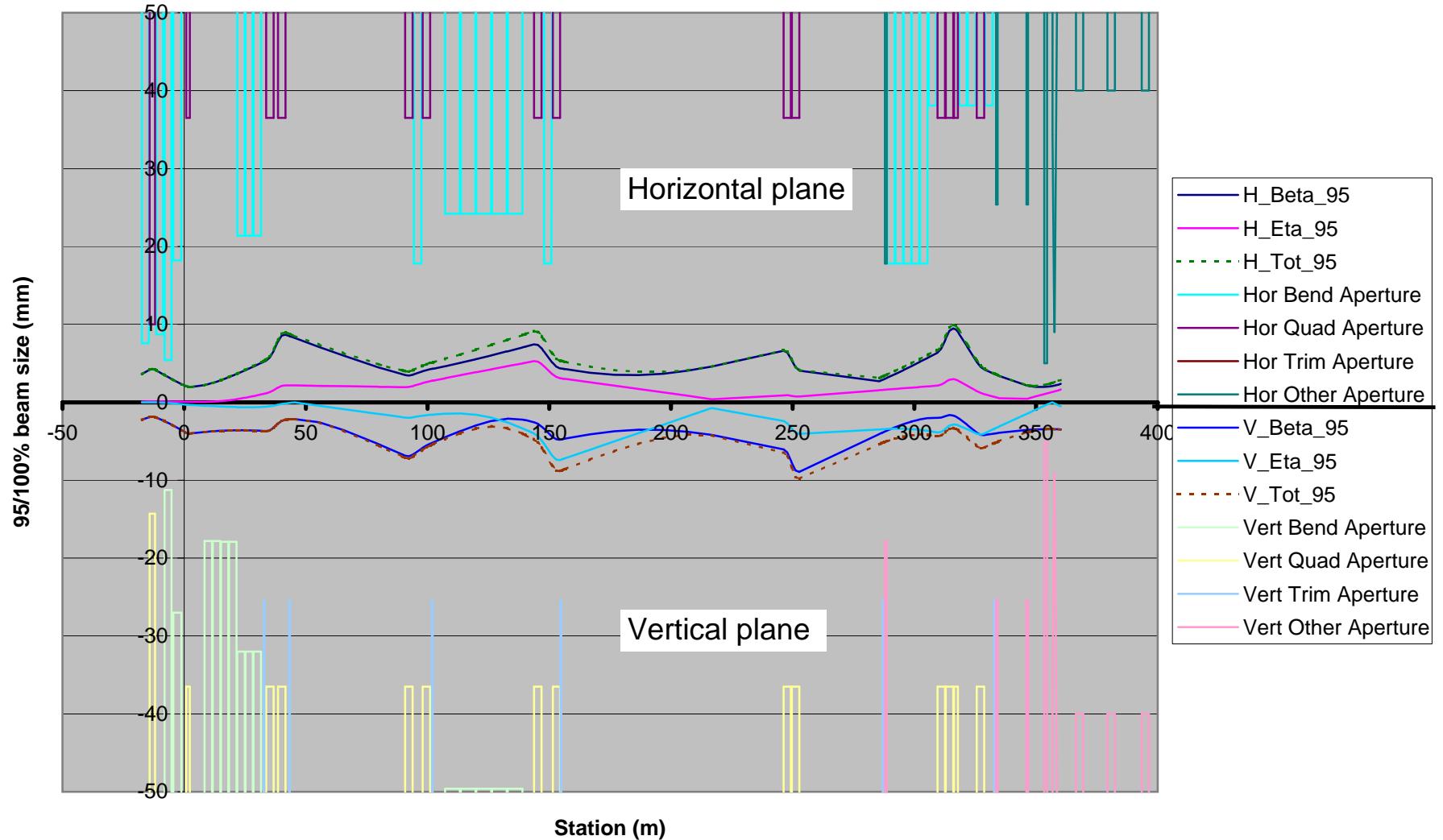
Three Generations of Beta Functions



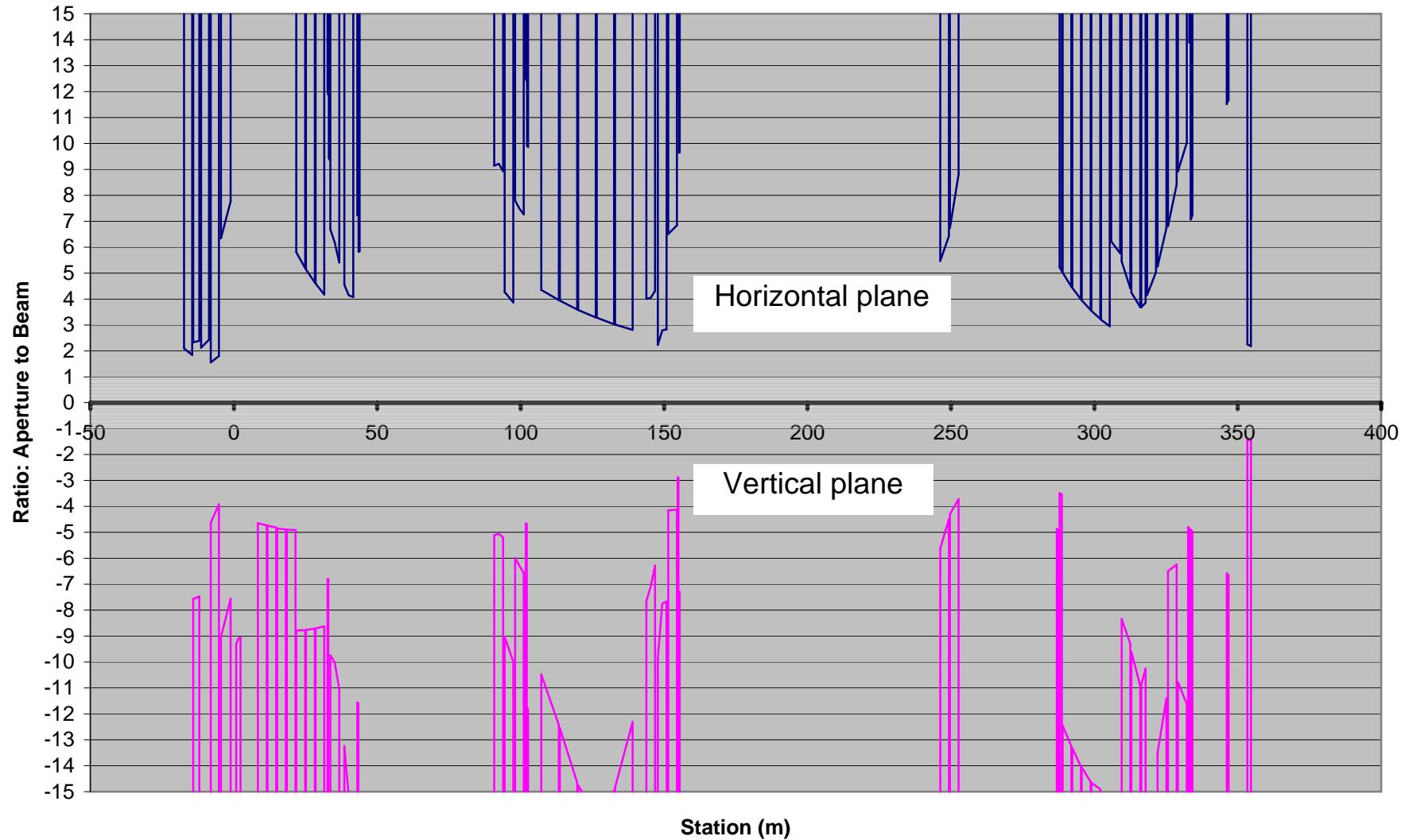
Three Generations of Eta Functions



95/100% Beam Sizes and Apertures

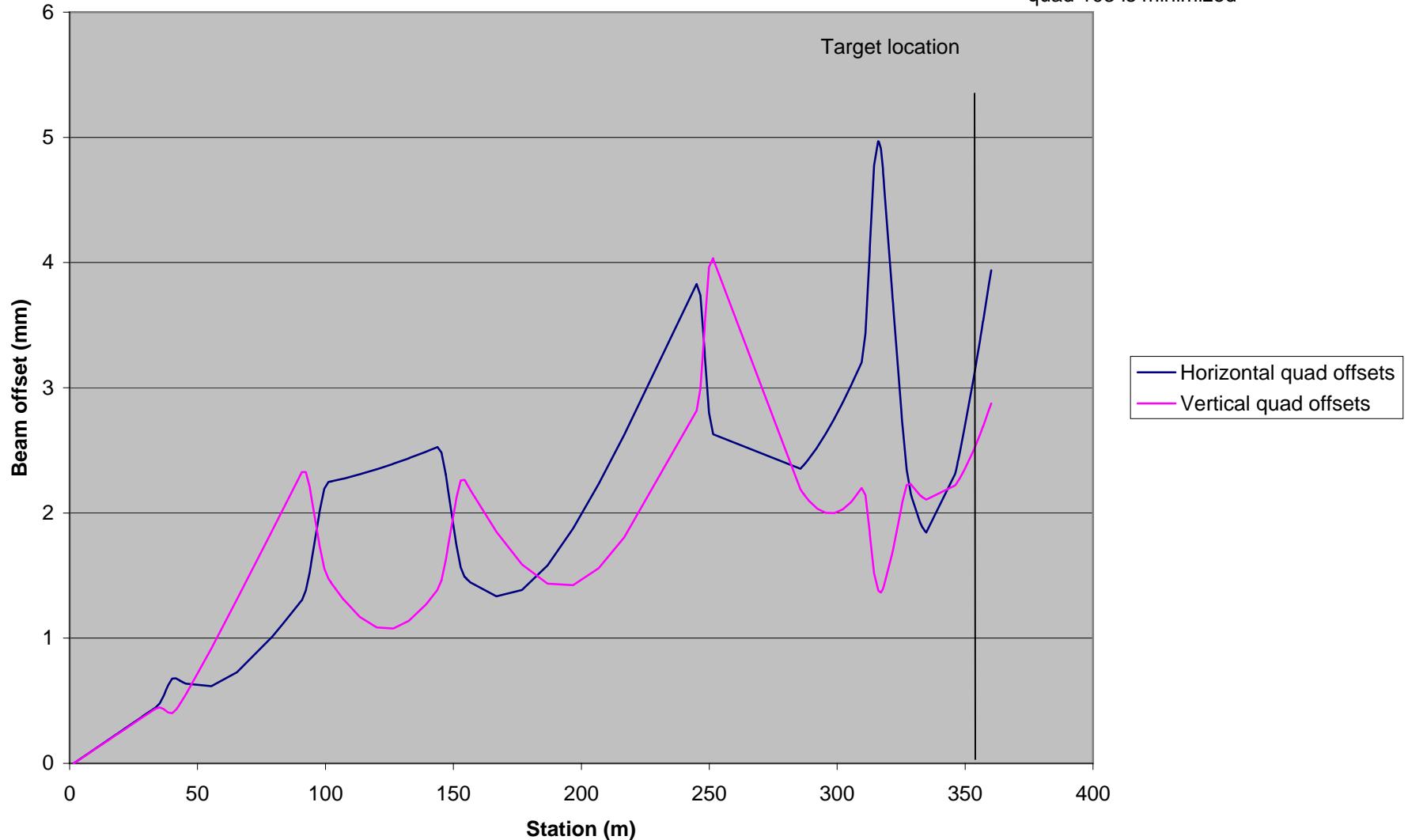


Ratio Plot



Combined Effect of .25mm Quad Offsets

This version of the combined magnet sensitivity plot is made after sensitivity to quad 103 is minimized



Summary of changes

- Add three new 3Q120 quadrupoles on two circuits
 - Plus power, water, vacuum
- Almost all quadrupoles run at increased current
 - Ramifications on sensitivity
- Replace one EPB dipole with a 6-3-120.
 - This probably requires one additional power supply
- Change magnet stands (not yet built), minimally in stub region, more significantly in pretarget
- Carrier pipe no longer parallel to carrier tunnel
- Free drift space between targeting BPM pairs cut by 2.1 meters out of 15 meters